

APPENDIX A

Benefit – Cost Analysis Summary and Technical Documentation

EXECUTIVE SUMMARY

A Benefit-Cost Analysis was conducted to quantify impacts of the Northgate Non-Motorized Access to Transit and Education project. Benefits and costs are calculated and presented throughout this document for the completed project referred to as “Northgate Non-Motorized Access to Transit and Education” as well as for the project’s two components.

1. Northgate pedestrian bridge, protected bicycle facilities, and associated improvements, referred to as “Bridge Construction”
2. Bikeshare Expansion, referred to as “Bikeshare Expansion”.

The total Northgate Non-Motorized Access to Transit and Education project produces the following benefits:

- *Benefit: Cost* – **Total benefit to cost ratio is 3.1**
- *Monetized Benefits* – **Monetized benefits exceed \$393 million over the life of the project¹**
- *Net Benefits* - Benefits net of costs exceed \$265 million
- *Mode Shift* - The primary source of benefits is the shifting of trips from motorized trips to walking and biking
- *Categories* - The mode-shift creates the following categories of benefits:
 - reduced emissions
 - fewer vehicle accidents
 - reduced health costs
 - decreased travel costs and
 - other factors detailed in this document.

The results of the Benefit-Cost analysis are shown in **Table 1**. Total monetized economic benefits are shown in **Table 2**.

¹ Benefits are in present value (discounted at 3% in 2015 year dollars).

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Table 1 — Summary of Benefit-Cost Analysis Results

Discounted Benefits		Total
Health Savings		222,721,879
Emissions Reduction		2,421,933
Vehicle Crash Reduction		18,457,506
Maintenance Savings		8,645,958
Congestion Reduction Savings		6,341,912
Travel Cost Savings		103,049,370
Travel Time Reduction Savings		31,696,131
Reduced Traffic Congestion Costs		6,189,358
Total Benefits	\$	393,334,689
Discounted Costs		Total
Capital	\$	48,485,665
Maintenance & Operation	\$	79,501,397
Total Benefits	\$	127,987,062
BCA Ratio		3.07
Net Discounted Benefits - Costs	\$	265,347,627

Table 2 — Long Term Outcomes (Present Value)

	3% Discount Rate		7% Discount Rate	
Quality of Life (Livability)				
Household Travel Savings	\$	103,049,370	\$	59,699,711
Travel Time Savings	\$	31,696,131	\$	13,154,612
Improved Health Benefits	\$	222,721,879	\$	146,295,691
Environmental Sustainability				
Reduced Emissions	\$	2,421,933	\$	997,785
Economic Competitiveness				
Reduced Traffic Congestion Costs	\$	6,341,912	\$	2,757,103
Safety				
Reductions in Collision Savings	\$	18,457,506	\$	8,024,490
State of Good Repair				
Reduction in Road Maintenance Costs	\$	8,645,958	\$	3,758,078

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Benefits for the two project components are shown below.

Bridge Construction

- *Benefit: Cost* – **Benefit to cost ratio is 2.4**
- *Monetized Benefits* – **Benefits total \$85 million over the life of the project²**
- *Net Benefits* - Benefits net of costs exceed \$50 million
- *Mode Shift* - The primary source of benefits is the shifting of trips to work, school and errands out of motor vehicles and into walking and biking
- *Categories* - The mode-shift creates the following categories of benefits:
 - decreased travel cost
 - reduced travel time
 - fewer emissions
 - decreased traffic congestion
 - reduced vehicle crashes
 - reduced road maintenance
 - decreased health costs

Bikeshare Expansion

- *Benefit:Cost* - **Benefit to cost ratio is 3.3**
- *Monetized Benefits* - **Benefits total \$307 million over the life of the project³**
- *Net Benefits* – Benefits net of costs total \$214 million
- *Mode Shift* - The primary source of benefits is the shifting of trips to bikeshare from other vehicular modes.
- *Categories* - The mode-shift creates the following categories of benefits
 - decreased travel cost
 - reduced travel time
 - fewer emissions
 - decreased traffic congestion
 - reduced vehicle crashes
 - reduced road maintenance
 - decreased health costs

Table 2A displays the benefits and costs of the project.

Table 2A- Northgate Non-Motorized Access to Transit and Education	
Present Value (2015 \$'s, 3% Discount Rate)	
Benefits	
Total Benefits	\$393,334,689
Bridge Construction	\$85,638,000
Bikeshare Expansion	\$307,696,689
Costs	
Total Costs	\$127,987,062
Bridge Construction	\$35,014,000
Bikeshare Expansion	\$92,973,062

² Benefits are in (75 years) in present value (discounted at 3% in 2015 year dollars).

³ Benefits over the life of the project (20 years) in present value (discounted at 3% in 2015 year dollars).

BENEFITS

Monetized Benefits

The Northgate Non-Motorized Access to Transit and Education project provides a wide range of benefits that can be monetized. The project provides significant health benefits by increased physical activity, reduced household transportation costs and travel time savings, reduced traffic congestion, improved safety, reduced road maintenance costs, and reduced vehicle emissions. Monetized benefits have been evaluated on the basis of aggregate mode shift to walking and bicycling modes facilitated by the project implementation.

Monetized benefits resulting from this shift have been estimated in the following categories:

- Reduced cost of vehicle emissions
- Reduced external costs of vehicle travel
 - Traffic congestion
 - Traffic crashes
 - Roadway maintenance
- Reduced healthcare costs
 - Reduction in medical care costs
 - Reduction in lost productivity
 - Reduction in workers compensation costs
- Travel time savings
- Reduced household transportation spending

Discount rates are applied specific to each project component as follows:

Bridge Construction

- 3% and 7% annual real rate
- 20 year evaluation period
- three years for project construction (2016-2018)
- 20 years of project benefits (2019-2038)
- Remaining net benefits of the fully-maintained facilities over their full 75 year asset life is claimed as a lump sum at the end of the analysis period in 2038.

Bikeshare Expansion

- 3% and 7% annual real rate
- 20 year evaluation period
- one and a half years for project construction (2016-2017)
- 20 years of project benefits (2017-2036).
- No benefit was calculated after the 20 year project lifespan as significant reinvestment (approaching initial investment) would be necessary at that date.

Qualitative Benefits

The project will also result in numerous qualitative benefits – not monetized for the benefit-cost analysis (BCA) – that will improve the quality of life and economic competitiveness of the region.

The additional qualitative benefits not monetized in the BCA are as follows for each project component:

Bridge Construction

- improved access to parks and open space
- improved access for disadvantaged communities
- improved access to job centers and employment services and
- improved connection of neighborhoods with retail businesses

Bike Share Expansion

- increased property values associated with access to new services
- improved access for disadvantaged communities currently underserved by public transit
- improved access to job centers and employment services and the accompanying increase in economic efficiency
- improved access to parks and open space
- increased trip distance due to introduction of electric bikes

Specific to bike share, it is important to note that the BCA does not monetize any increase in trip distance or trip number due to the introduction of electric bicycles. As the first large scale electric bike share system in the country, no precedent exists to show a change in travel behavior with electric bikes. However, new research coming out of the Institute of Transport Economics finds that people travel more often and farther on personal electric bicycles. Trip distance more than doubled, going from 4.8 to 10.3 kilometers per trip. Daily trips likewise increased from .9 to 1.4 trips per day.

Had the trip length been doubled to 4.2 instead of 2.1 miles in our BCA, consistent with the results of the study from the Institute for Transport Economics the overall BCA ratio would increase to 3.77 from 3.68 and net benefits would increase from \$238,561,655 to \$246,582,942.

PROJECT COSTS

Costs are as follows:

- Total actual project construction costs: \$54.5M
 - Bridge Construction, construction: \$36.3M
 - Bikeshare Expansion, equipment and construction \$18.2M
- Total project annual operations and maintenance cost: \$5.4M
 - Bridge, operations and maintenance: \$29,000
 - Bikeshare Expansion, operations and maintenance: \$5.4M

Bridge construction costs were prepared by KPFF Consulting Engineers in 2014. Bikeshare costs were estimated by the Seattle Department of Transportation based on the experience of other cities.

METHODOLOGY

To ensure a seamless benefit-cost analysis, the two project components, Bridge Construction and Bikeshare Expansion, use similar methods and categories for analysis. The Northgate Non-Motorized Access to Transit and Education BCA expands on the methodology suggested by National Cooperative Highway Research Program (NCHRP) Report 552: *Guidelines for Analysis of Investments in Bicycle Facilities* by incorporating local demographic information and utilizing new data and research that has become available since the *Guidelines for Analysis* were published in 2006.

One notable enhancement is the consideration of benefits from both bicycling and walking activity, using different impact areas for each mode. By comparison, NCHRP methodology attempts to measure only bicycling benefits, and does not quantify pedestrian benefits for shared-use paths. Another key improvement is the estimate of utilitarian (non-commute) and access to transit in addition to work commute trips. This addition helps capture the full range of walking and bicycling activity in the project area. The benefit-cost analysis also considers local travel patterns, trip distances and public health data to create a detailed, complete picture of benefits generated by the proposed bicycle and pedestrian facilities.

A major advantage of this benefit-cost analysis approach is the ability to quantify benefits at a line-item level for each distinct type of benefit associated with the project. This allows benefits to be quantified and compared for each TIGER grant selection criterion. This also means the benefit-cost analysis omits calculation of recreational benefits of the project from the analysis, so that it can be evaluated solely on its merits as a transportation facility in accordance with TIGER grant selection guidelines. By contrast, the standard NCHRP benefit-cost analysis includes recreational benefits that often make up 90% of the calculated value of bicycle projects, due to savings from newly active people. These methodology improvements should be considered when comparing benefit-cost analysis results for this project with other TIGER grant applications.

TECHNICAL DOCUMENTATION

BASELINE DATA INPUTS – BRIDGE CONSTRUCTION

Demographics

The benefit-cost analysis related to the Bridge Construction considers several population groups within two project impact areas: a half-mile buffer area for walking impacts and a three-mile buffer area for bicycling impacts. These geographies are standard areas of influence used by bicycle and pedestrian planning professionals and were recently acknowledged by the Federal Transit Administration in the *Final Policy Statement on the Eligibility of Pedestrian and Bicycle Improvements Under Federal Transit Law* that went into effect August 19, 2011. Population groups within these areas were quantified using the following sources:

Employed Populations

BCA input: Employed population

Source:

2008-2012 American Community Survey (ACS) 5-Year Estimates, U.S. Census Bureau. *TCRP Report 153: Guidelines for Providing Access to Public Transit Stations, 2012*, Transit Cooperative Research Program. "Average station access mode share by station type"

Method: The number of employed people within the walking and bicycling impact areas was captured at a census block group level for block groups with their geographic center located within a half-mile or three mile buffer of proposed projects, respectively. This population is used in conjunction with Journey to Work mode split data. A portion of the employed population that journey to work via transit were also assumed to access trips via cycling and walking. The assumed station type used was Urban Neighborhood with Parking.

Student Populations

BCA input: College student population

Source: *2008-2012 American Community Survey (ACS) 5-Year Estimates*, U.S. Census Bureau.

Method: The populations of college-enrolled students living within the walking and bicycling impact area were captured for Census Block Groups with their geographic center located within the project impact areas. The data represent the most recent demographic estimates available for the area.

Travel Patterns – Mode Share

Baseline mode share data was collected for driving, bicycling and walking activity among the different demographic groups listed above. The following data sources were used to estimate mode split for each group:

Employed Populations

BCA input: Mode split of employed population (Journey to Work)

Source: *2008-2012 American Community Survey (ACS) 5-Year Estimates*, U.S. Census Bureau.

Student Populations

BCA input: Mode split of college students

Source: *Data Extraction Tool*, 2009 National Household Travel Survey (NHTS)⁴

Method: College student mode shares were based on travel survey data from the 2009 National Household Transportation Survey. National numbers were used in lieu of local college estimates, which aggregate bicycle and walking trips.

⁴ <http://nhts.ornl.gov/det/Extraction3.aspx>

Travel Patterns – Trip Length and Purpose

Area residents will use the bicycle and pedestrian transportation facilities for more than just work commute trips. To capture the full range of walking and bicycling activity, an estimated number of trips of other purposes were extrapolated from work trips based on data from the 2009 National Household Travel Survey (NHTS).⁵ NHTS shows that for every work trip Americans make by bicycle, they also make an average of 1.61 utilitarian (non-commute) trips by bicycle. For walking, this ratio is 4.32.

To accurately estimate the relative benefits resulting from each type of bicycling and walking trip, each trip was weighted according to the average distance for a trip of that mode and purpose. Trip distance multipliers were also provided by NHTS Average trip distances were assigned as follows:

- Bicycling trips:
 - Work commute trips: 3.54 miles
 - College commute trips: 2.09 miles
 - Utilitarian trips: 1.89 miles
- Walking trips:
 - Work commute trips: 0.67 miles
 - College commute trips: 0.56 miles
 - Utilitarian trips: 0.67 miles

Travel Patterns – New Trips Utilizing Bridge Construction

Trip generation was calculated as above for the walking and bicycling catchment areas on both the east and west sides of the bridge. Using the trip purpose and mode, a proportion of trips were distributed over the bridge, as given in **Table 3**. Few commute trips were assumed to cross the bridge, while a larger number of trips to access transit, particularly by walking, are assumed to cross when the bridge opens. The largest group assumed to cross the bridge are college trips, both walking and bicycling, generating from the east side of the bridge. This distribution is expected to increase, and a 1% growth rate was applied from the bridge opening in 2019.

Table 3 — Bridge Construction New Trip Distribution				
	West		East	
	Bicycling	Walking	Bicycling	Walking
Weekday commute trips				
Bicycling/walking trips	2.00%	1.00%	2.00%	1.00%
Walk- or bike-to-transit trips	1.50%	5.00%	1.00%	3.00%
College bicycle/walking trips	0.00%	5.00%	30.00%	30.00%
Daily utilitarian trips	2.00%	1.00%	2.00%	1.00%

⁵ <http://nhts.ornl.gov/tables09/Login.aspx?ReturnUrl=/tables09/ae/TableDesigner.aspx>

BASELINE DATA INPUTS – BIKE SHARE EXPANSION

Demographics

The Bikeshare Expansion benefit-cost analysis considers population within a designated service area and determines an expected number of bikeshare users and trips/year based on demographic indicators.

BCA Input: Trips

Source: A linear model was created to estimate the total number of annual trips based on data from seven bikeshare systems:

1. Hubway – Boston, MA; Brookline, MA; Cambridge, MA; Somerville, MA
2. Nice Ride MN – Minneapolis, MN; St. Paul, MN
3. Capital Bikeshare – Washington, DC; Montgomery County, MD; Alexandria, VA; Arlington County, VA
4. Denver B-cycle – Denver, CO
5. Divvy – Chicago, IL
6. CoGo – Columbus, OH
7. Bikeshare Toronto – Toronto, ON

The independent variables for the linear regression are the population of the bikeshare service area and the number of jobs in the bikeshare service area. The bikeshare service area is defined as the land area that is within a quarter-mile from each peripheral station in the system. The service area does not need to be contiguous. The dependent variable for the regression is trips per month, which was calculated from total annual trips and normalized to the number of operating months the system has. The data sources for the ridership model are listed in **Table 4**.

Table 4 — Sources for Ridership Model

	Population of the service area	Jobs in the service area	Trips per month
Hubway	U.S. Census Bureau, 2009-2013 5-Year American Community Survey, Table B01003, Block Group level data.	U.S. Census Bureau, American Community Survey 2006-2010 Five-year estimates. Special Tabulation: Census Transportation Planning, Table A202100.*	North American Bikeshare Association, International Bike-Share Database, 2015. Data is self-reported.
Nice Ride MN		U.S. Census Bureau. 2013. OnTheMap Application. Longitudinal-Employer Household Dynamics Program. http://onthemap.ces.census.gov/ . Selected 2011 Primary Jobs.	
Capital Bikeshare			
Denver B-cycle			
Divvy			
CoGO			
Bikeshare Toronto	Statistics Canada, 2011 National Household Survey	Toronto Employment Survey, 2011, Table 4, http://www1.toronto.ca/city_of_toronto/city_planning/sipa/files/pdf/survey2011.pdf	

BCA Input: Unique bikeshare users (annual members & casual users)

Source: It was assumed that Seattle would have a similar ratio of casual user trips to member trips as Boston and Washington, DC, both of which are 0.28. This ratio was provided directly by Hubway and Capital Bikeshare. Boston and Washington, DC were chosen because of they are the most similar cities to Seattle for which data was available. The ridership model was used to calculate total trips per month for Seattle. This was then converted to casual user trips per month and annual member trips per month using the 0.28 ratio. This was then converted to unique users by assuming that casual members take 2.2 trips/month and annual members take 7 trips/month, based on 2-years of Capital Bikeshare ridership data that was compiled in Chicago DOT's successful TIGER Grant application from 2011. It was assumed that every casual pass sold was a unique user.

Travel Patterns – Mode Shift, Split, and Speed

BCA Input: Alternative mode split of bikeshare trips

Source: Survey data from Capital Bikeshare (Washington D.C.) and Hubway (Boston), asking bikeshare users what mode they would use for their trip if bikeshare did not exist.

In order to calculate travel time savings the BCA needs average travel speed for each mode of transportation used in Seattle.

BCA Inputs: Average travel speed: Walk, Personal Bike, Electric Bike, Bus & Streetcar, Light Rail, Carsharing, Taxi, Personal Car

Sources:

Bike & E-Bike - Cherry, Christopher. "Electric Bike Use in China and Their Impacts on the Environment, Safety, Mobility and Accessibility." April 1, 2007. Accessed May 21, 2015. Pg. 13

Bus & Streetcar - 2013 King County Metro Bus, Trolleybus, DART, Streetcar (Revenue Miles/Revenue Hours) <http://metro.kingcounty.gov/am/reports/annual-measures/service-provided.html>

Light Rail - <http://seattletransitblog.com/2009/12/30/link-light-rail-in-the-north-american-context/>
Personal Car, Taxi and Carsharing – Assumption based on Google Maps direction data compiled here for many US cities: <http://infinitemonkeycorps.net/projects/cityspeed/>

Travel Patterns – Trip Length

The Bikeshare Expansion will provide both standard bicycles and electric bicycles (e-bikes) for rent. These distinct modes have different usage characteristics and therefore, different average trip lengths.

BCA Inputs: Average Trip Length

Source: Average trip length was calculated as the average of three peer cities for which data was available: Minneapolis, Boston, and Denver.

Note: E-Bike and Conventional Bike trip lengths are identical in the BCA as reliable research was not available on the subject. However, reliable research shows that average travel speed of E-bikes is significantly higher. This suggests that the average trip length for an E-bike would be longer. This effect was not quantified in the BCA but a longer E-bike trip length would increase the magnitude of benefits for emissions reduction, crash reduction, maintenance reduction, congestion reduction, travel cost savings, and travel time savings.

FORECASTS AND ASSUMPTIONS

Demographics

Bridge Construction

Future estimates were created by using linear growth rates to match Puget Sound Regional Council (PSRC) 2040 population and demographic forecasts by the 934 zone TAZ for the bicycling and walking impact areas. These growth rates were used to create annual estimates for each year evaluation period ending in 2038 through linear extrapolation between the base year (2012) and forecast year (2040).

Bikeshare Expansion

Service area population: U.S. Census Bureau, 2009-2013 5-Year American Community Survey, Table B01003, Block Group level data.

Travel Patterns

Bridge Construction

The Bridge Construction will have a strong influence on travel patterns in the bicycling and walking impact areas. Bicycling and walking mode shift curves were forecasted for each population group.

Employed Population

Mode shift forecasts for work commute trips within the bicycling and walking impact areas was based on mode shares documented by ACS Journey to Work data for other west coast communities that have made comparable investments in bicycling and walking transportation. According to the 2014 Alliance for Biking & Walking *2014 Benchmarking Report* Seattle has the fourth highest bicycling and walking commute levels of large US cities. A future mode share of 10% for cycling commute trips and 4% for walking trips were selected to reflect the changing land use and mode shift goals and targets observed elsewhere. Bicycle access to mode share was assumed to increase over time to levels consistent access mode share seen in other west coast cities as reported in the BART Bicycle Plan: Modeling Access to Transit, 2010, Bay Regional Transit Authority.

College Population

For college students, bicycling and walking growth rates were scaled to match the forecast growth rates for work commute trips.

Bikeshare Expansion

The Bikeshare Expansion will have a significant impact on travel behavior in the project area. Mode shift towards biking and away from other modes was projected using survey data from bikeshare users in Washington D.C. and Boston. Mode shift was calculated as fixed percentages applied to a growing ridership base. In other words, the mode share of the bikeshare system was not projected to grow more than is observed in more mature systems throughout the country.

Estimating Change From Baseline

Bridge Construction

For each year in the benefit-cost analysis period, forecasted mode shift was multiplied by demographic data to estimate increases over baseline for the following figures for both bicycling and walking modes:

- Work commute bicycling/walking users and number of trips, access to transit trips for work purposes
- College commute bicycling/walking users and number of trips

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- Number of utilitarian (non-commute) bicycling/walking trips, based on NHTS trip purpose ratios from number of work and college bicycling/walking users

Trip distances are estimated according to the transportation mode and purpose of the trip from NHTS 2009 data. Each new bicycling and walking trip was assumed to have a chance to replace a trip of any other mode equal to the baseline mode split for that trip type, with bicycling or walking removed from the total mode split. For example, if baseline drive alone mode share was 80% for college trips, with baseline bicycling mode share at 5%, a trip shifted to bicycling was assumed to have a 80% of out 95% chance (100% mode split – 5% bicycling, removed) of replacing a drive alone trip, or about 84.2%. These assumptions allow estimates for the following figures:

- Reduced vehicle trips
- Reduced VMT

The number of bicycling/walking users and VMT reduced were used in conjunction with benefit multipliers to monetize the benefits of the forecasted mode shift by year.

Bikeshare Expansion

The benefits of the Bikeshare Expansion were quantified in two main ways, using VMT reduction and Trips Diverted from each existing mode.

VMT Methodology-

- For each year, *bikeshare trips* are multiplied by *percentage of trips diverted* from modes that contribute to VMT (Personal Car, Taxi, & Carsharing) and by *average trip length*. This results in a VMT reduction per year.
- VMT reduction per year is then multiplied by benefit multipliers for **Emissions, Crash Reduction, Maintenance Savings, and Congestion Reduction** to produce dollar effects for each benefit.

Trips Diverted Methodology-

- *Alternative mode split percentages* (what mode would a bikeshare user have used for a given trip if bikeshare facilities did not exist) are multiplied by *total bikeshare trips* (minus a small percentage of trips caused by induced demand) to produce *trips diverted* from each alternative mode.
- **Household Travel Cost Savings** are calculated by multiplying *the number of trips diverted* per mode by their respective *cost per trip* benefit multiplier.
- **Travel Time Savings** are calculated by multiplying trips diverted per mode by (bikeshare travel time minus the travel time of a given mode). This travel time savings per mode is then multiplied by the value of *travel time benefit multiplier*
- **Health Savings** are calculated using *trips diverted* and *unique users*. Unique users are divided into annual members and casual users, each have slightly different methodologies.
 - Annual users – the number of *annual members* is multiplied by the *mode shift percentage from inactive modes* (Bus, Rail, Carsharing, Taxi, and Personal Car) and by the overall *percentage of inactive adults* in society. This yields a figure of annual users that transition from an inactive to an active lifestyle. The number of *newly active annual users* is multiplied by the *health benefit multiplier* to quantify the benefits of becoming active in dollar terms.
 - Casual users – the number of *casual users* is multiplied by the overall *percentage of inactive adults in society*. This yields the number of *newly active casual users* due to

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Seattle bikeshare. Since casual users may only use bikesharing facilities a few times per year the *health benefit multiplier* is discounted by 50%.

BENEFIT MULTIPLIERS

Based on available research, the following types of benefits were quantified for the Northgate Non-Motorized Access to Transit and Education project using the increased number of bicycling/walking users and reduced VMT forecast annually:

- Reduced cost of vehicle emissions
- Reduced external costs of vehicle travel
 - Traffic congestion
 - Traffic crashes
 - Roadway maintenance
- Reduced healthcare costs
 - Reduction in medical care costs
 - Reduction in lost productivity
 - Reduction in workers compensation costs
- Travel time savings
- Reduced household transportation spending

Multipliers used to translate new bicycling/walking users and reduced VMT into the benefits listed above were drawn from the following sources:

Vehicle Emissions Rates

Emission Facts: Average Annual Emissions and Fuel Consumption for Gasoline-Fueled Passenger Cars and Light Trucks (EPA report 420-F-05-022).⁶

- Carbon dioxide: 369 g/VMT
- Carbon monoxide: 12.4 g/VMT
- Hydrocarbons: 1.36 g/VMT
- Particulate matter: 0.0052 g/VMT (PM10) and 0.0049 g/VMT (PM2.5)
- Nitrous oxides: 0.95 g/VMT

Emissions Costs

- From NHTSA Corporate Average Fuel Economy for MY 2011 Passenger Cars and Light Trucks, Table VIII-5⁷ Volatile organic compounds: \$1,700/ton
- Particulate matter: \$168,000/ton
- Nitrous oxides: \$4,000/ton

Technical Support Document: Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis Under Executive Order 12866 (May 2013; revised November 13), page 18

- Carbon dioxide: \$57/ton (in 2019 escalating per source - See *Tiger Benefit-Cost Analysis (BCA) Resource Guide* for additional information.)

External Vehicle Travel Costs

Crashes vs. Congestion – What's the Cost to Society? AAA, 2008. (Figure ES.2, pg ES-4 and Figure ES.3, pg ES-5).⁸

⁶ <https://www.whatcomsmarttrips.org/pdf/Emission%20Facts%202005.pdf>

⁷ http://www.nhtsa.dot.gov/portal/site/nhtsa/menuitem.d0b5a45b55bfbe582f57529_cdba046a0

⁸ <http://newsroom.aaa.com/Assets/Files/20083591910.CrashesVsCongestionFullReport2.28.08.pdf>

- Traffic crashes: \$0.37/VMT
- Traffic congestion: \$0.13/VMT.

Notes: Cost of crashes divided by 7.21, ratio of crash to congestion costs.

Kitamura, R., Zhao, H., and Gubby, A. R. *Development of a Pavement Maintenance Cost Allocation Model*. Institute of Transportation Studies – University of California, Davis.⁹

- Roadway maintenance: \$0.15/VMT

Vehicle Operating Costs

Average Cost of Owning and Operating an Automobile. 2011 [most recent data year] Bureau of Transportation Statistics.¹⁰

- Reduced household transportation cost: \$0.596/VMT

2012 National Transportation Statistics (Table 3-17: Average Cost of Owning and Operating an Automobile, 2012). Research and Innovative Technology Administration, Bureau of Transportation Statistics.¹¹

Cost of Travel Time

TIGER BCA Resource Guide (2014). FHWA. Recommended Hourly Values of Travel Time Savings.

- Hourly monetized value of \$12.98 for all surface transportation of all types was used

Travel time differences between modes is based upon average distance by type of trip and speed of travel, assuming trips by vehicle, transit and bike have a small fixed time component for waiting (transit), walking to-and-from vehicle or bike, start-up and shut-down procedures and parking.

Health Benefits

Health Care Reduction Modifier: \$1,144.38

Method: The Health Care Reductions Multiplier was derived from the health care figures provided in the report cited in the footnote below. This report references 1998 Behavioral Risk Factor Surveillance System (BRFSS) data^{12 13} Detail on the application of these reports is included in the attached BCA spreadsheet.

RESIDUAL BENEFITS TO END OF PROJECT LIFE

Bridge Construction

The expected lifespan for the bridge is 75 years before the bridge will require substantial maintenance or replacement. Since this analysis only captures 20 years of benefits from the facility, a residual value of the investment is left over. The yearly maintenance on the bridge retains the facility in good repair, so the value of the investment is retained. The value of this remaining net benefit is conservatively estimated by assuming the annual benefits, net of O&M costs, for the remaining life

⁹ http://pubs.its.ucdavis.edu/publication_detail.php?id=19

¹⁰ http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_03_17.html

¹¹ http://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/publications/national_transportation_statistics/html/table_03_17.html

¹² Chenoweth, D. (2005). The Economic Costs of Physical Inactivity, Obesity, and Overweight in California Adults: Health Care, Workers' Compensation, and Lost Productivity. Topline Report.

<http://www.cdph.ca.gov/healthinfo/healthyliving/nutrition/Documents/CostofObesityToplineReport.pdf>

¹³ Population Estimates Program, Population Division, U.S. Census Bureau (1999). ST-99-1 State Population Estimates and Demographic Components of Population Change: July 1, 1998 to July 1, 1999. <http://www.census.gov/population/estimates/state/st-99-1.txt>

remain constant at 2038 levels. Discounted to 2038, this value is \$105 million, which is added as a benefit in the final year of the analysis.

Bikeshare Expansion

The lifespan of the Bikeshare Expansion is estimated at 20 years. Therefore, no residual benefits were calculated as the system would require substantial reinvestment, likely equal to the initial capital costs.

2015 YEAR DOLLARS

All benefit multipliers have been converted from their original sources to 2015 year dollars using Bureau of Labor Statistics. CPI Inflation Calculator.¹⁴ The stream of benefits and costs are calculated in 2015 constant year dollars prior to discounting to present value.

DISCOUNTING

Net present values were calculated by discounting the stream of project benefits and costs using both the 3% and 7% real rates as endorsed in the Federal Register grant announcement.

¹⁴ Bureau of Labor Statistics. CPI Inflation Calculator. http://www.bls.gov/data/inflation_calculator.htm

NORTHGATE NON-MOTORIZED ACCESS TO TRANSIT AND EDUCATION

BENEFIT-COST ANALYSIS RESULTS

Bridge Construction

The project will deliver significant net benefits over its 75 year life, with an estimated net present value of \$51 million at 3% discount rate. This results in a BCA Ratio of 2.46. The benefit-cost analysis results tables are available on the following pages. The original Excel document used to calculate the results is available in the BCA attachment. **Table 5** demonstrates the summary of net benefits and **Table 6** displays the individual benefits at 3% and 7% discounts.

Bikeshare Expansion

The project will deliver significant net benefits over its 20 year life, with an estimated net present value of \$214,723,627 million at 3% discount rate. This results in a BCA Ratio of 3.68. The benefit-cost analysis results tables are available on the following pages. The original Excel document used to calculate the results is available in the BCA attachment. **Tables 7 and 8** demonstrate the summary of net benefits for 3% and 7%, respectively, and **Table 9** displays the individual benefits at 3% and 7% discounts.

Table 5 - Summary of Net Benefits (Northgate Bridge Construction)

Calendar Year	Initial Project Costs	Remaining Life Net Benefits at End of Analysis Period (3)	Operations and Maintenance Costs (1)	Benefits (2)	Net Annual Benefits	Cumulative Benefits
2016	\$ 11,747,572					
2017	\$ 11,405,411					
2018	\$ 11,073,214					
2019			\$ 25,766	\$ 1,250,538	\$ 1,224,772	\$ (33,001,425)
2020			\$ 25,016	\$ 1,280,197	\$ 1,255,181	\$ (31,746,244)
2021			\$ 24,287	\$ 1,310,632	\$ 1,286,345	\$ (30,459,899)
2022			\$ 23,580	\$ 1,342,498	\$ 1,318,918	\$ (29,140,981)
2023			\$ 22,893	\$ 1,375,078	\$ 1,352,185	\$ (27,788,796)
2024			\$ 22,226	\$ 1,408,749	\$ 1,386,523	\$ (26,402,272)
2025			\$ 21,579	\$ 1,443,402	\$ 1,421,823	\$ (24,980,449)
2026			\$ 20,950	\$ 1,479,164	\$ 1,458,214	\$ (23,522,235)
2027			\$ 20,340	\$ 1,516,347	\$ 1,496,007	\$ (22,026,228)
2028			\$ 19,748	\$ 1,554,470	\$ 1,534,722	\$ (20,491,506)
2029			\$ 19,172	\$ 1,593,659	\$ 1,574,486	\$ (18,917,020)
2030			\$ 18,614	\$ 1,634,178	\$ 1,615,564	\$ (17,301,455)
2031			\$ 18,072	\$ 1,675,530	\$ 1,657,459	\$ (15,643,997)
2032			\$ 17,545	\$ 1,719,001	\$ 1,701,456	\$ (13,942,541)
2033			\$ 17,034	\$ 1,763,423	\$ 1,746,389	\$ (12,196,152)
2034			\$ 16,538	\$ 1,809,257	\$ 1,792,719	\$ (10,403,433)
2035			\$ 16,057	\$ 1,856,551	\$ 1,840,495	\$ (8,562,939)
2036			\$ 15,589	\$ 1,905,232	\$ 1,889,643	\$ (6,673,295)
2037			\$ 15,135	\$ 1,955,901	\$ 1,940,766	\$ (4,732,529)
2038		\$ 53,363,363	\$ 14,694	\$ 2,007,766	\$ 55,356,435	\$ 50,623,906
Net Present Value:						\$ 50,623,906

Notes:

NORTHGATE NON-MOTORIZED ACCESS TO TRANSIT AND EDUCATION

- (1) Estimated annual maintenance cost of \$29,000. This maintenance level will preserve the full value and functionality of the facilities for 75 years.
- (2) Includes all monetized benefits of the project, including: air quality and carbon benefits of reduced vehicle emissions; reduced costs of traffic congestion, crashes and road maintenance; healthcare cost savings; and reduced household travel time and transportation expenses.
- (3) Credit in 2038 for additional 55 years of remaining net benefits of fully maintained transportation facilities at end of the 20-year analysis period.

Table 6: Net Present Value (Northgate Bridge Construction) Discounted at 3% and 7%

Table 6 - Net Present Value Discounted at 3% and 7%							
Calendar Year	Household Travel Savings		Travel Time Savings		Improved Health Benefits		
	3% Discount	7% Discount	3% Discount	7% Discount	3% Discount	7% Discount	
2019	\$ 419,931	\$ 360,571	\$ 309,465	\$ 88,776	\$ 78,876	\$ 67,727	
2020	\$ 429,648	\$ 355,124	\$ 305,762	\$ 92,685	\$ 79,951	\$ 66,083	
2021	\$ 439,718	\$ 349,860	\$ 302,173	\$ 96,802	\$ 81,070	\$ 64,503	
2022	\$ 450,067	\$ 344,708	\$ 298,629	\$ 101,089	\$ 82,195	\$ 62,953	
2023	\$ 460,746	\$ 339,695	\$ 295,171	\$ 105,590	\$ 83,354	\$ 61,454	
2024	\$ 471,780	\$ 334,827	\$ 291,792	\$ 110,341	\$ 84,567	\$ 60,018	
2025	\$ 483,143	\$ 330,073	\$ 288,472	\$ 115,296	\$ 85,791	\$ 58,611	
2026	\$ 494,863	\$ 325,442	\$ 285,220	\$ 120,523	\$ 87,068	\$ 57,260	
2027	\$ 506,944	\$ 320,923	\$ 282,030	\$ 125,971	\$ 88,354	\$ 55,933	
2028	\$ 519,435	\$ 316,538	\$ 278,920	\$ 131,745	\$ 89,712	\$ 54,669	
2029	\$ 532,279	\$ 312,239	\$ 275,849	\$ 137,790	\$ 91,095	\$ 53,437	
2030	\$ 545,563	\$ 308,068	\$ 272,860	\$ 144,121	\$ 92,506	\$ 52,236	
2031	\$ 559,243	\$ 303,988	\$ 269,917	\$ 150,787	\$ 93,965	\$ 51,077	
2032	\$ 573,365	\$ 300,013	\$ 267,036	\$ 157,799	\$ 95,471	\$ 49,955	
2033	\$ 587,927	\$ 296,132	\$ 264,206	\$ 165,168	\$ 97,019	\$ 48,867	
2034	\$ 602,950	\$ 292,346	\$ 261,432	\$ 172,914	\$ 98,610	\$ 47,812	
2035	\$ 618,451	\$ 288,652	\$ 258,713	\$ 181,056	\$ 100,247	\$ 46,788	
2036	\$ 634,409	\$ 285,031	\$ 256,031	\$ 189,604	\$ 101,921	\$ 45,792	
2037	\$ 650,868	\$ 281,494	\$ 253,397	\$ 198,607	\$ 103,651	\$ 44,828	
2038	\$ 667,866	\$ 278,047	\$ 250,819	\$ 208,066	\$ 105,426	\$ 43,891	
2039-2093	\$ 17,881,730	\$ 3,875,962	\$ 3,496,404	\$ 11,443,655	\$ 2,822,709	\$ 611,837	
TOTAL 2015 Present Value	\$ 1,900,000	\$ 656,000	\$ 25,538,000	\$ 9,064,000	\$ 4,644,000	\$ 1,706,000	

NORTHGATE NON-MOTORIZED ACCESS TO TRANSIT AND EDUCATION

Table 6 (continued): Net Present Value (Northgate Bridge Construction) Discounted at 3% and 7%

Table 6 - Net Present Value Discounted at 3% and 7%

Calendar Year	Reduced Emissions		Reduced Traffic Congestion Costs		Reductions in Accident Savings		Reduction in Road Maintenance Costs	
	3% Discount	7% Discount	3% Discount	7% Discount	3% Discount	7% Discount	3% Discount	7% Discount
2019	\$ 22,972	\$ 19,725	\$ 69,859	\$ 59,984	\$ 203,227	\$ 174,500	\$ 95,263	\$ 81,797
2020	\$ 23,799	\$ 19,671	\$ 71,476	\$ 59,078	\$ 207,929	\$ 171,863	\$ 97,467	\$ 80,561
2021	\$ 24,357	\$ 19,379	\$ 73,151	\$ 58,202	\$ 212,803	\$ 169,316	\$ 99,751	\$ 79,367
2022	\$ 25,549	\$ 19,568	\$ 74,873	\$ 57,345	\$ 217,811	\$ 166,822	\$ 102,099	\$ 78,198
2023	\$ 26,472	\$ 19,517	\$ 76,649	\$ 56,511	\$ 222,980	\$ 164,397	\$ 104,522	\$ 77,061
2024	\$ 27,431	\$ 19,468	\$ 78,485	\$ 55,701	\$ 228,319	\$ 162,040	\$ 107,025	\$ 75,956
2025	\$ 28,424	\$ 19,418	\$ 80,375	\$ 54,911	\$ 233,818	\$ 159,740	\$ 109,602	\$ 74,878
2026	\$ 29,454	\$ 19,370	\$ 82,325	\$ 54,140	\$ 239,491	\$ 157,498	\$ 112,261	\$ 73,827
2027	\$ 30,870	\$ 19,542	\$ 84,335	\$ 53,388	\$ 245,337	\$ 155,312	\$ 115,002	\$ 72,802
2028	\$ 31,988	\$ 19,493	\$ 86,413	\$ 52,659	\$ 251,382	\$ 153,190	\$ 117,835	\$ 71,808
2029	\$ 33,145	\$ 19,443	\$ 88,549	\$ 51,944	\$ 257,598	\$ 151,109	\$ 120,749	\$ 70,832
2030	\$ 34,347	\$ 19,395	\$ 90,759	\$ 51,250	\$ 264,027	\$ 149,091	\$ 123,763	\$ 69,886
2031	\$ 35,209	\$ 19,138	\$ 93,035	\$ 50,571	\$ 270,647	\$ 147,116	\$ 126,866	\$ 68,961
2032	\$ 36,886	\$ 19,301	\$ 95,384	\$ 49,910	\$ 277,482	\$ 145,192	\$ 130,070	\$ 68,059
2033	\$ 38,228	\$ 19,255	\$ 97,807	\$ 49,264	\$ 284,529	\$ 143,314	\$ 133,373	\$ 67,178
2034	\$ 39,619	\$ 19,210	\$ 100,306	\$ 48,634	\$ 291,799	\$ 141,482	\$ 136,781	\$ 66,319
2035	\$ 41,063	\$ 19,165	\$ 102,885	\$ 48,020	\$ 299,301	\$ 139,694	\$ 140,298	\$ 65,482
2036	\$ 42,559	\$ 19,121	\$ 105,539	\$ 47,417	\$ 307,024	\$ 137,941	\$ 143,917	\$ 64,660
2037	\$ 44,558	\$ 19,271	\$ 108,278	\$ 46,829	\$ 314,990	\$ 136,230	\$ 147,651	\$ 63,858
2038	\$ 46,181	\$ 19,226	\$ 111,105	\$ 46,256	\$ 323,216	\$ 134,562	\$ 151,507	\$ 63,076
2039-2093	\$ 1,236,481	\$ 268,014	\$ 2,974,784	\$ 644,801	\$ 8,653,917	\$ 1,875,783	\$ 4,056,523	\$ 879,273
TOTAL 2015 Present Value	\$ 1,900,000	\$ 656,000	\$ 4,746,000	\$ 1,697,000	\$ 13,808,000	\$ 4,936,000	\$ 6,472,000	\$ 2,314,000

NORTHGATE NON-MOTORIZED ACCESS TO TRANSIT AND EDUCATION

Table 7 - Summary of Net Benefits (Bikeshare Expansion), Discounted at 3% Real Rate

Calendar Year	Initial Project Costs	Operations and Maintenance Costs	Benefits (2)	Net Annual Benefits	Cumulative Benefits
2016	\$ 7,716,436		\$	(7,716,436)	\$ (7,716,436)
2017	\$ 6,543,229	\$ 5,136,676	\$ 7,463,468	\$ (4,216,437)	\$ (11,932,873)
2018		\$ 4,987,064	\$ 16,195,539	\$ 11,208,475	\$ (724,398)
2019		\$ 4,841,810	\$ 17,963,363	\$ 13,121,553	\$ 12,397,155
2020		\$ 4,700,787	\$ 17,684,975	\$ 12,984,189	\$ 25,381,344
2021		\$ 4,563,870	\$ 17,410,580	\$ 12,846,709	\$ 38,228,053
2022		\$ 4,430,942	\$ 17,140,441	\$ 12,709,499	\$ 50,937,553
2023		\$ 4,301,886	\$ 16,874,494	\$ 12,572,609	\$ 63,510,161
2024		\$ 4,176,588	\$ 16,612,674	\$ 12,436,086	\$ 75,946,247
2025		\$ 4,054,940	\$ 16,355,218	\$ 12,300,278	\$ 88,246,525
2026		\$ 3,936,835	\$ 16,101,454	\$ 12,164,620	\$ 100,411,145
2027		\$ 3,822,170	\$ 15,851,628	\$ 12,029,458	\$ 112,440,603
2028		\$ 3,710,844	\$ 15,605,678	\$ 11,894,834	\$ 124,335,437
2029		\$ 3,602,761	\$ 15,363,260	\$ 11,760,498	\$ 136,095,935
2030		\$ 3,497,827	\$ 15,125,167	\$ 11,627,340	\$ 147,723,275
2031		\$ 3,395,948	\$ 14,890,488	\$ 11,494,540	\$ 159,217,815
2032		\$ 3,297,037	\$ 14,659,451	\$ 11,362,414	\$ 170,580,229
2033		\$ 3,201,007	\$ 14,431,998	\$ 11,230,991	\$ 181,811,221
2034		\$ 3,107,774	\$ 14,208,075	\$ 11,100,301	\$ 192,911,522
2035		\$ 3,017,256	\$ 13,987,885	\$ 10,970,629	\$ 203,882,150
2036		\$ 2,929,375	\$ 13,770,852	\$ 10,841,477	\$ 214,723,627
2037					
2038					
				Net Present Value:	\$ 214,723,627

NORTHGATE NON-MOTORIZED ACCESS TO TRANSIT AND EDUCATION

Table 8 - Summary of Net Benefits (Bikeshare Expansion), Discounted at 7% Real Rate

Calendar Year	Initial Project Costs	Operations and Maintenance Costs	Benefits (2)	Net Annual Benefits	Cumulative Benefits
2016	\$ 7,716,436		\$ (7,716,436)	\$ (7,716,436)	
2017	\$ 6,543,229	\$ 4,759,804	\$ 6,915,882	\$ (4,387,151)	\$ (12,103,587)
2018		\$ 4,448,415	\$ 14,446,271	\$ 9,997,856	\$ (2,105,731)
2019		\$ 4,157,397	\$ 15,424,157	\$ 11,266,760	\$ 9,161,029
2020		\$ 3,885,418	\$ 14,617,453	\$ 10,732,035	\$ 19,893,063
2021		\$ 3,631,232	\$ 13,852,684	\$ 10,221,452	\$ 30,114,515
2022		\$ 3,393,675	\$ 13,127,926	\$ 9,734,252	\$ 39,848,766
2023		\$ 3,171,659	\$ 12,441,087	\$ 9,269,429	\$ 49,118,195
2024		\$ 2,964,167	\$ 11,790,183	\$ 8,826,016	\$ 57,944,211
2025		\$ 2,770,249	\$ 11,173,541	\$ 8,403,291	\$ 66,347,503
2026		\$ 2,589,018	\$ 10,588,953	\$ 7,999,935	\$ 74,347,437
2027		\$ 2,419,643	\$ 10,034,951	\$ 7,615,307	\$ 81,962,745
2028		\$ 2,261,349	\$ 9,509,933	\$ 7,248,584	\$ 89,211,329
2029		\$ 2,113,410	\$ 9,012,217	\$ 6,898,807	\$ 96,110,136
2030		\$ 1,975,150	\$ 8,540,865	\$ 6,565,716	\$ 102,675,851
2031		\$ 1,845,934	\$ 8,094,017	\$ 6,248,082	\$ 108,923,934
2032		\$ 1,725,172	\$ 7,670,546	\$ 5,945,374	\$ 114,869,308
2033		\$ 1,612,310	\$ 7,269,232	\$ 5,656,921	\$ 120,526,230
2034		\$ 1,506,832	\$ 6,888,914	\$ 5,382,081	\$ 125,908,311
2035		\$ 1,408,254	\$ 6,528,614	\$ 5,120,359	\$ 131,028,670
2036		\$ 1,316,126	\$ 6,187,044	\$ 4,870,918	\$ 135,899,589
2037					
2038					
				Net Present Value:	\$ 135,899,589

Note:

- (4) Includes all monetized benefits of the project, including: air quality and carbon benefits of reduced vehicle emissions; reduced costs of traffic congestion, crashes and road maintenance; healthcare cost savings; and reduced household travel time and transportation expenses.

NORTHGATE NON-MOTORIZED ACCESS TO TRANSIT AND EDUCATION

Table 9 - Net Present Value Discounted at 3% and 7% (Bikeshare Expansion)								
Calendar Year	Household Travel Savings			Travel Time Savings		Improved Health Benefits		
	3% Discount	7% Discount		3% Discount	7% Discount	3% Discount	7% Discount	
2017	\$ 5,171,775	\$ 4,792,328	\$	157,574	\$ 146,013	\$ 1,906,775	\$ 1,766,877	
2018	\$ 11,297,567	\$ 10,077,325	\$	336,757	\$ 300,385	\$ 4,075,038	\$ 3,634,896	
2019	\$ 12,752,657	\$ 10,950,009	\$	358,259	\$ 307,618	\$ 4,335,228	\$ 3,722,423	
2020	\$ 12,554,558	\$ 10,376,924	\$	352,694	\$ 291,518	\$ 4,267,884	\$ 3,527,604	
2021	\$ 12,359,535	\$ 9,833,833	\$	347,215	\$ 276,261	\$ 4,201,587	\$ 3,342,982	
2022	\$ 12,167,543	\$ 9,319,165	\$	341,822	\$ 261,803	\$ 4,136,320	\$ 3,168,022	
2023	\$ 11,978,532	\$ 8,831,433	\$	336,512	\$ 248,101	\$ 4,072,066	\$ 3,002,219	
2024	\$ 11,792,458	\$ 8,369,227	\$	331,285	\$ 235,116	\$ 4,008,811	\$ 2,845,094	
2025	\$ 11,609,274	\$ 7,931,212	\$	326,138	\$ 222,811	\$ 3,946,538	\$ 2,696,192	
2026	\$ 11,428,936	\$ 7,516,120	\$	321,072	\$ 211,150	\$ 3,885,232	\$ 2,555,083	
2027	\$ 11,251,399	\$ 7,122,753	\$	316,085	\$ 200,099	\$ 3,824,879	\$ 2,421,359	
2028	\$ 11,076,620	\$ 6,749,974	\$	311,175	\$ 189,626	\$ 3,765,464	\$ 2,294,633	
2029	\$ 10,904,556	\$ 6,396,704	\$	306,341	\$ 179,702	\$ 3,706,971	\$ 2,174,540	
2030	\$ 10,735,165	\$ 6,061,923	\$	301,582	\$ 170,297	\$ 3,649,387	\$ 2,060,733	
2031	\$ 10,568,405	\$ 5,744,664	\$	296,897	\$ 161,384	\$ 3,592,698	\$ 1,952,881	
2032	\$ 10,404,236	\$ 5,444,008	\$	292,285	\$ 152,938	\$ 3,536,889	\$ 1,850,674	
2033	\$ 10,242,616	\$ 5,159,088	\$	287,745	\$ 144,934	\$ 3,481,947	\$ 1,753,817	
2034	\$ 10,083,508	\$ 4,889,080	\$	283,275	\$ 137,348	\$ 3,427,858	\$ 1,662,028	
2035	\$ 9,926,871	\$ 4,633,203	\$	278,875	\$ 130,160	\$ 3,374,610	\$ 1,575,043	
2036	\$ 9,772,667	\$ 4,390,717	\$	274,543	\$ 123,348	\$ 3,322,189	\$ 1,492,611	
TOTAL 2015 Present Value	\$218,078,879	\$144,589,691	\$	6,158,131	\$	4,090,612	\$	74,518,370 \$49,499,711

NORTHGATE NON-MOTORIZED ACCESS TO TRANSIT AND EDUCATION

Table 9 (continued): Net Present Value Discounted at 3% and 7% (Bikeshare Expansion)

Table 9 - Net Present Value Discounted at 3% and 7% (Bikeshare Expansion)										
Calendar Year	Reduced Emissions		Reduced Traffic Congestion Costs		Reductions in Accident Savings		Reduction in Road Maintenance Costs			
	3% Discount	7% Discount	3% Discount	7% Discount	3% Discount	7% Discount	3% Discount	7% Discount		
2017	\$ 11,909	\$ 11,035	\$ 40,836	\$ 37,840	\$ 118,972	\$ 110,243	\$ 55,627	\$ 51,546		
2018	\$ 25,763	\$ 22,981	\$ 87,272	\$ 77,846	\$ 254,258	\$ 226,796	\$ 118,883	\$ 106,042		
2019	\$ 27,408	\$ 23,534	\$ 92,845	\$ 79,721	\$ 270,493	\$ 232,257	\$ 126,474	\$ 108,596		
2020	\$ 27,637	\$ 22,843	\$ 91,403	\$ 75,548	\$ 266,291	\$ 220,102	\$ 124,509	\$ 102,912		
2021	\$ 27,530	\$ 21,904	\$ 89,983	\$ 71,594	\$ 262,154	\$ 208,582	\$ 122,575	\$ 97,526		
2022	\$ 27,420	\$ 21,001	\$ 88,585	\$ 67,847	\$ 258,082	\$ 197,666	\$ 120,671	\$ 92,422		
2023	\$ 27,306	\$ 20,132	\$ 87,209	\$ 64,297	\$ 254,073	\$ 187,321	\$ 118,796	\$ 87,585		
2024	\$ 27,189	\$ 19,297	\$ 85,854	\$ 60,932	\$ 250,126	\$ 177,517	\$ 116,951	\$ 83,001		
2025	\$ 27,372	\$ 18,700	\$ 84,520	\$ 57,743	\$ 246,241	\$ 168,226	\$ 115,134	\$ 78,657		
2026	\$ 27,245	\$ 17,917	\$ 83,208	\$ 54,721	\$ 242,416	\$ 159,422	\$ 113,346	\$ 74,541		
2027	\$ 27,115	\$ 17,165	\$ 81,915	\$ 51,857	\$ 238,650	\$ 151,078	\$ 111,585	\$ 70,639		
2028	\$ 26,983	\$ 16,443	\$ 80,642	\$ 49,143	\$ 234,943	\$ 143,172	\$ 109,852	\$ 66,942		
2029	\$ 26,564	\$ 15,582	\$ 79,390	\$ 46,571	\$ 231,293	\$ 135,678	\$ 108,145	\$ 63,439		
2030	\$ 26,711	\$ 15,083	\$ 78,157	\$ 44,133	\$ 227,700	\$ 128,578	\$ 106,465	\$ 60,119		
2031	\$ 26,571	\$ 14,443	\$ 76,942	\$ 41,824	\$ 224,163	\$ 121,848	\$ 104,811	\$ 56,972		
2032	\$ 26,430	\$ 13,829	\$ 75,747	\$ 39,635	\$ 220,681	\$ 115,471	\$ 103,183	\$ 53,991		
2033	\$ 26,286	\$ 13,240	\$ 74,571	\$ 37,560	\$ 217,253	\$ 109,428	\$ 101,580	\$ 51,165		
2034	\$ 26,141	\$ 12,675	\$ 73,412	\$ 35,595	\$ 213,878	\$ 103,701	\$ 100,002	\$ 48,487		
2035	\$ 26,252	\$ 12,253	\$ 72,272	\$ 33,732	\$ 210,556	\$ 98,273	\$ 98,449	\$ 45,949		
2036	\$ 26,099	\$ 11,726	\$ 71,149	\$ 31,966	\$ 207,285	\$ 93,130	\$ 96,920	\$ 43,545		
TOTAL 2015 Present Value	\$ 521,933	\$ 341,785	\$ 1,595,912	\$ 1,060,103	\$ 4,649,506	\$ 3,088,490	\$ 2,173,958	\$ 1,444,078		